

What is claimed is

1. A method of forming a SiGe layer on an insulator comprising:

providing a silicon substrate;

5 depositing a SiGe layer with a surface on the silicon substrate, whereby a Si/SiGe interface is formed;

implanting ions into the SiGe layer between the surface of the SiGe layer and the Si/SiGe interface, whereby a defect zone is formed;

10 patterning and etching the SiGe layer, whereby a patterned SiGe layer is formed; and

transferring the patterned SiGe layer to an insulator layer.

2. The method of claim 1, wherein the SiGe layer is a strained SiGe layer.

15 3. The method of claim 1, wherein the SiGe layer is a relaxed SiGe layer.

4. The method of claim 1, wherein the SiGe layer is between approximately 20nm and 1000nm thick.

20 5. The method of claim 1, wherein the layer of SiGe has a
Ge concentration in the range of between approximately 10% and
60%.

 6. The method of claim 4, wherein the layer of SiGe has a
graded Ge concentration.

25 7. The method of claim 4, wherein the layer of SiGe has
an essentially constant Ge concentration.

 8. The method of claim 1, wherein the ions comprise ions
of hydrogen, helium, or a combination of hydrogen and argon,
helium or boron.

30 9. The method of claim 1, wherein the patterned SiGe
layer comprises feature sizes between approximately 100nm and
2cm.

35 10. The method of claim 1, wherein transferring the
patterned SiGe layer comprises bonding the surface of the
patterned SiGe layer to an insulating layer on a second substrate to
form a bonded couplet and thermally annealing the couplet to split
the SiGe layer along the defect zone.

 11. The method of claim 2, further comprising annealing
the SiGe layer to relax the SiGe layer.

12. A method of forming a strained silicon film overlying
40 an insulator comprising:
providing a silicon substrate;
depositing a strained SiGe layer with a surface on the
silicon substrate, whereby a Si/SiGe interface is formed;
implanting ions into the strained SiGe layer between
45 the surface of the strained SiGe layer and the Si/SiGe
interface;
patterning and etching the strained SiGe layer,
whereby a patterned, strained SiGe layer is formed;
transferring the patterned, strained SiGe layer to an
50 insulator layer;
relaxing the strained SiGe layer, whereby the strained
SiGe layer becomes a relaxed SiGe layer, and
epitaxially forming a strained silicon film over the
relaxed SiGe layer.

55 13. The method of claim 12, wherein the SiGe layer is
between approximately 20nm and 1000nm thick.

14. The method of claim 12, wherein the layer of SiGe has
a Ge concentration in the range of between approximately 10% and
60%.

60 15. The method of claim 14, wherein the layer of SiGe has
a graded Ge concentration.

16. The method of claim 14, wherein the layer of SiGe has an essentially constant Ge concentration.

65 17. The method of claim 12, wherein the ions comprise ions of hydrogen, helium, or a combination of hydrogen and argon, helium or boron.

18. The method of claim 12, wherein the patterned SiGe layer comprises feature sizes between approximately 100nm and 2cm.

70 19. The method of claim 12, wherein transferring the patterned SiGe layer comprises bonding the surface of the patterned SiGe layer to an insulating layer on a second substrate to form a bonded couplet and thermally annealing the couplet to split the SiGe layer along the defect zone

75 20. The method of claim 19, wherein relaxing the strained SiGe layer comprises additional thermal annealing.

21. A method of forming a SiGe-free strained silicon film
on an insulator comprising:

providing a silicon substrate;

80 depositing a SiGe layer with a surface on the silicon
substrate, whereby a Si/SiGe interface is formed;

depositing a thin epitaxial silicon layer on the surface
of the SiGe layer;

85 implanting ions through the epitaxial silicon layer into
the SiGe layer between the surface of the SiGe layer and the
Si/SiGe interface;

patterning and etching epitaxial silicon layer and the
SiGe layer, whereby a patterned Si/SiGe stack is formed;

90 transferring the patterned Si/SiGe stack to an
insulator layer by bonding the epitaxial silicon layer to an
insulating layer on a second substrate to form a bonded
couplet and thermally annealing the couplet to split the SiGe
layer along the defect zone, whereby patterned regions of
SiGe over silicon over insulator is formed.

95 relaxing the SiGe layer, whereby the epitaxial silicon
becomes a strained silicon film;

removing the SiGe layer.